R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE SPECIFICATION

The specification has been amended at page 26, line 18 to replace "the later harmonic mode" with "higher lateral mode" to use the correct technical term. The specification has also been amended at page 32, lines 25-26 to replace "light absorption between valence bands" with "inter valence band absorption (IVBA)" to use the correct technical term.

No new matter has been added, and it is respectfully requested that the amendments to the specification be approved and entered.

THE CLAIMS

Claim 1 has been amended to incorporate the subject matter of claim 17, rewritten to avoid the language objected to by the Examiner on page 3 of the Office Action).

Claim 1 has also been amended to clarify that the active layer has a width and a thickness which are constant in a direction of a resonator length L, as supported by Fig. 1 and the disclosure in the specification at, for example, page 33, lines 5-7.

In addition, claim 1 has been amended to recite that the n-type cladding layer made of InGaAsP has a refractive index that is higher than a refractive index of the p-type cladding layer made of InP, so that distribution of light generated in the active layer is biased to the n-type cladding layer to suppress an increase of optical loss due to inter valance band absorption in the p-type cladding layer, as supported by, for example, Fig. 8 and the disclosure in the specification at, for example, page 32, lines 14-27.

Still further, claim 1 has been amended to clarify that light which oscillates only in a fundamental lateral mode to be emitted from an exit facet is configured to be optically coupled with an external single mode optical fiber without generation of a higher lateral mode, as supported by the disclosure in the specification at, for example, page 26, lines 11-19.

Yet still further, claim 1 has been amended to recite that the light emitted from the exit facet has a spot size such that a ratio of a horizontal size to a vertical size of the spot size is in a range of 1:0.65 to 1:1.35, as supported by, for example, Fig. 4 and the disclosure in the specification at, for example, page 24, line 17 to page 25, line 10.

The claims have also been amended to make some grammatical improvements so as to put them in better form for issuance in a U.S. patent. With respect to claims 6-11, the term "assuming,"

which was objected to by the Examiner on page 2 of the Office Action, has been deleted. Accordingly, it is respectfully requested that the rejection of claims 6-11 under 35 USC 112, second paragraph, be withdrawn.

Claim 16, moreover, has been canceled. Accordingly, it is respectfully submitted that the rejection thereof under 35 USC 112 is now moot.

No new matter has been added, and it is respectfully requested that the amendments to the claims be approved and entered.

It is respectfully submitted, moreover, that the all of the claims are now in full compliance with the requirements of 35 USC 112, second paragraph, and it is respectfully requested that the rejections thereunder be withdrawn.

THE PRIOR ART REJECTION

Claims 1-19 were rejected under 35 USC 103 as being obvious in view of the combination of "Asymmetric-Cladding 1480-nm Pump Laser With CW Fiber Output Power of 1 W" ("Nagashima et al") and JP 09-289354 ("Nishikawa et al"). These rejections, however, are respectfully traversed with respect to the claims as amended hereinabove.

According to the present invention as recited in amended independent claim 1, a semiconductor laser is provided which

comprises: (i) a substrate made of InP; (ii) an active layer including a multiquantum well structure formed above the substrate, the active layer having a width and a thickness which are constant in a direction of a resonator length L, the width of the active layer being in a range of 7 to 14 μm; and (iii) an n-type cladding layer made of InGaAsP and a p-type cladding layer made of InP which are formed above the substrate with the active layer interposed therebetween, a bandgap wavelength of the InGaAsP of the n-type cladding layer being in a range between 0.96 μm and 0.98 μm.

In addition, as recited in amended independent claim 1, the n-type cladding layer made of InGaAsP has a refractive index that is higher than a refractive index of the p-type cladding layer made of InP, so that distribution of light generated in the active layer is biased to the n-type cladding layer to suppress an increase of optical loss due to inter valance band absorption in the p-type cladding layer.

Still further, as recited in amended independent claim 1, light which oscillates only in a fundamental lateral mode to be emitted from an exit facet is configured to be optically coupled with an external single mode optical fiber without generation of a higher lateral mode, and the light emitted from the exit facet has a spot size such that a ratio of a horizontal size to a vertical size of the spot size is in a range of 1:0.65 to 1:1.35.

Thus, with the structure recited in amended independent claim 1, the semiconductor laser has an n-type cladding layer made of InGaAsP and a p-type cladding layer made of InP with an active layer interposed therebetween. By limiting the bandgap wavelength of InGaAsP which composes the n-type cladding layer to 0.96 μm to 0.98 μm (as recited in amended independent claim 1), the following advantages can be obtained:

1. Since the thickness and the width of the active layer are constant in the direction of the resonator length, a higher lateral mode would not occur even if the active layer were extended to a width (7 to 14 μm, as recited in amended independent claim 1) suitable for optical coupling with a single mode optical fiber;

2. Since the n-type cladding layer is made of InGaAsP, the light distribution in the vertical direction can be wider and the spot can be nearly circular (the ratio of the horizontal size to the vertical size of the spot size is 1:0.65 to 1:1.35, as recited in amended independent claim 1); and

3. Since the light distribution in the vertical direction is biased to the n-type cladding layer (as recited in amended independent claim 1), inter valence band absorption (IVBA) in the p-type cladding layer is reduced (as also recited in amended independent claim 1), whereby laser light of high output can be obtained.

On page 4 of the Office Action, the Examiner states, "Nagashima et al is silent as to the width of the active layer being within the range of 7-14 μm." However, the Examiner asserts that this structure recited in claim 1 is well known in the art, and as support, the Examiner refers to paragraphs [0022]-[0024] of Nishikawa et al.

It is respectfully pointed out that according to amended independent claim 1, the thickness and the width of the active layer are constant in the direction of the resonator length. By contrast, according to Nishikawa et al the active layer is tapered such that the width thereof increases from W2 to W1 in the direction of the resonator length, as clear from FIG. 1(c). Therefore, the structure of the active layer of the semiconductor laser according to claim 1 differs from the structure of the active layer according to Nishikawa et al.

In addition, according to claim 1 the light emitted from the exit facet has a spot size such that a ratio of a horizontal size to a vertical size of the spot size is in a range of 1:0.65 to 1:1.35. Nagashima et al does not disclose this structure of claim 1. According to Nishikawa et al, moreover, the width of the active layer is increased as a tapered shape as described above, so that a semiconductor laser with a large spot diameter is realized. With this configuration, however, Nishikawa et al. merely realizes a spot size of 10μm in the horizontal direction

and 2.4 μm in the vertical direction (paragraph [0024]). Thus, the spot size in the vertical direction is still as small as 2.4 μm. Although this characteristic has been improved as compared to the conventional art described in Nishikawa at al., the optical coupling efficiency is as low as 45% (paragraph [0024]). This value is far from an ideal optical coupling efficiency. And it is respectfully submitted that the structure recited in independent claim 1 also differs from the structure disclosed by Nishikawa et al with respect to the ratio of horizontal size to vertical size of the spot size.

Thus, it is respectfully submitted that claim 1 differs in structure from Nagashima et al and Nishikawa et al, and it is respectfully submitted that even if Nagashima et al and Nishikawa et al were combinable in the manner suggested by the Examiner, the structure recited in independent claim 1 still would not be achieved or rendered obvious.

Moreover, it is noted that on page 5 of the Office Action, with respect to claims 16 and 17, the Examiner asserts that page 148 of Nagashima et al discloses bandgap wavelengths of 0.99, 1.08 and 1.15 μm. However, the wavelengths 0.99, 1.08, 1.15 μm pointed to by the Examiner represent the composition of the layers constituting the OCL (SCH) layer, which do not correspond to the n-type cladding layer made of InGaAsP having a bandgap wavelength in a range between 0.96 μm and 0.98 μm recited in

claim 1. Furthermore, the wavelengths of 0.99, 1.08, 1.15 μm pointed to by the Examiner do not fall within the range of 0.96-0.98 μm recited in amended independent claim 1.

In view of the foregoing, it is respectfully submitted that the present invention as recited in amended independent claim 1 and claims 2-15, 18 and 19 depending therefrom clearly patentably distinguish over Nagashima et al and Nishikawa et al under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

Respectfully submitted,

/Douglas Holtz/

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